species differ in the character of the teeth, especially in number and form of the premolars.

In one species from Aliwal North the molar teeth are transversely wide, ornamented with three transverse ridges, which terminate in a slight cusp both on the external and internal margins. There are not more than nine molars. The crown of the first premolar in one specimen is elongated from front to back, and shows a small coronet of rounded marginal cusps. In a species from Lady Frere the molar teeth are narrower and the premolar teeth more numerous, small, and circular in the broken sections.

Although these skulls are mammalian in aspect, and in some respects make new transitions towards mammals, in technical characters they retain a sufficient number of reptilian structures to permit no doubt that they are true reptiles. The mammalian resemblances in the skull being paralleled in the other parts of the skeleton, it may be affirmed that these fossils demonstrate a closer affinity between reptiles and mammals than had previously been evident.—*From the Proceedings of the Royal Society.* (Communicated by the Author.)

The Transformation of the Aortic Arches in the Frog.

By M. S. Jourdain.

In the course of investigations which for several years I have pursued upon frogs I have had occasion to study, by the aid of injections, the transformations undergone by the large vessels which spring from the bulb of the aorta at the time of transition from aquatic to aerial life. The results of my observations differ to such an extent from those which are recorded in the treatises on zootomy, that I have decided to present them to the Academy.

We know that in the tadpole of the frog the gills are four in number. The fourth, which is situated behind the rest, is considerably less developed than the other three.

In order to render my description more intelligible I shall have to modify the customary terminology in certain respects. I designate the great vessels, four in number, which carry the venous blood to the gills, *bulbar arches* (*crosses bulbaires*); *hypobranchial vessels* is the term that I apply to the portion subdivided from each of these arches which distributes itself to the gills, and by *epibranchial vessels* I mean the portion which brings back the aerated blood to the origin of the arteries which spring from these epibranchials. These arteries are, in the case of the first arch, the carotid linguals; in that of the second the aorta; in that of the third and fourth the cutaneous respiratory and the pulmonary.

The epibranchial vessels are united one to another on each side, at a short distance from the point of their emergence from the gill, by anastomotic branches, which have a longitudinal direction and are termed by me *connective branches* (*rameaux connectifs*).

Finally, it is important to note the presence of a short and wide anastomotic plexus, to which I shall apply the term *interbranchial*,

and which establishes a more and more free communication between the hypo- and the epibranchials towards the point where these latter issue from the gill.

In a general way the constitution of the definitive type of the circulatory system is realized by the direct inosculation of the bulbar arches with the origin of the arteries arising from the epibranchials, by the medium of the interbranchials, and the disappearance of the entire branchial circulatory system with the gill itself.

We will now see what takes place in the case of each of the branchial arches.

First arch.—The short vascular plexus which represents the interbranchial establishes a direct communication between the first bulbar arch and the carotid lingual, which then constitutes the termination of the former. The interbranchial becomes the carotid gland. The connective between the first and second arches disappears.

Second arch.—An open anastomosis is formed, by means of the interbranchial, between the second bulbar arch and the origin of the aorta. The connective between the second and third arches atrophies.

Third and fourth arches.—In the case of these arches a more complex transformation takes place.

By means of the third interbranchial and of the connective between the third and fourth arches, which persists, the third bulbar arch becomes continuous with the afferent vessel of the lung, or pulmonary artery, which chiefly arises from the epibranchial of the fourth arch.

The fourth bulbar arch, which is merely a subdivision of the third, loses its function and atrophies.

The pulmonary artery of the adult, constituted by the various sections which I have just enumerated (third bulbar arch, third interbranchial, and the connective between the third and fourth arches), gives rise, on a level with the third gill, to a vessel which may be ascribed to the epibranchial of that gill, and which forms the extremely interesting branch of the pulmonary artery known as the *cutaneous respiratory*.

When the pulmonary sac begins to develop it receives a vessel fed by the epibranchial of the fourth arch and also by the connective between the third and fourth. The result of this arrangement is that this pulmonary vessel, which is none other than the pulmonary artery, receives *already aerated* blood, mingled with a small quantity of venous blood coming from the interbranchial anastomoses. Thus in reality at the outset this artery is a nutritive vessel like the other arteries.

Towards the close of larval life, when the lung is a functional respiratory organ, the artery maintains its nutritive *rôle*, but, in addition to this, the blood that it contains is aerated afresh and the pulmonary veins bring back pure arterial blood to the heart.

Finally, in the adult the pulmonary artery conveys almost pure venous blood, and thus commences to realize the conditions exhibited by the circulatory system of vertebrates with separate ventricles.—*Comptes Rendus*, t. cxix. no. 1 (July 2, 1894), pp. 98–100.

Branchiate Pulmonates. By M. Paul Pelseneer.

I. Among the aquatic pulmonate Mollusca of Madagascar there is found a sinistral form which normally exhibits, below the pulmonary aperture and to the left of the anus, a well constituted *gill*. This gill is *plicated*, and not pectinated (that is to say, that it is formed like that of the Opisthobranchs), and is attached merely by its base. But it is not homologous with the gill or ctenidium of the rest of the Gastropoda: it is, as a matter of fact, situated entirely outside the pallial chamber, while in the latter it is contained within it. It is therefore a new formation.

II. The appearance of this organ upon a Pulmonate is explained by the study of our indigenous forms, certain of which already possess this gill, but in a less developed condition: *Planorbis* and *Ancylus* may be taken as instances.

Planorbis corneus exhibits, outside the pallial or pulmonary chamber and to the left of the anus, a flattened, smooth, and extensile tegumentary lobe, the structure of which reveals its respiratory function; the same lobe, proportionately smaller, exists in *Planorbis marginatus*.

Ancylus also possesses this lobe (on the right side in *A. lacustris*), which in this case has for a long time already been designated the *gill*, and which performs the functions of such an organ in a continuous manner, for in this genus *there is no longer any trace of a pallial chamber (or lung)*. Now we know that *Planorbis* is of a much less aerial habit than *Limnæa*, and we are also aware that in pure water *Ancylus* remains almost entirely immersed (which explains the disappearance of its lung).

These Pulmonates, having lost the original molluscan gill (or ctenidium), but having subsequently reverted to an aquatic life, there is nothing astonishing in the fact that they have developed a fresh gill, morphologically different from the former, although in the case of the Pulmonate from Madagascar it has a similar conformation; we have here merely a remarkable example of *homoplasy* and of the irreversibleness of evolution, that is to say of the powerlessness of an organ which has been lost to reappear.

III. The mollusk from Madagascar in question is only known conchologically, and bears the name *Physa lamellata*. But its whole organization shows that it does not belong to the genus *Physa*; I confine myself here to pointing out the absence in the latter (as in *Limnæa*) of the para-anal branchial apparatus.

Physa lamellata constitutes the type of a genus very closely allied to *Planorbis*, which I propose to term *Pulmobranchia*.—*Comptes Rendus*, t. cxix. no. 5 (July 30, 1894), pp. 354, 355.